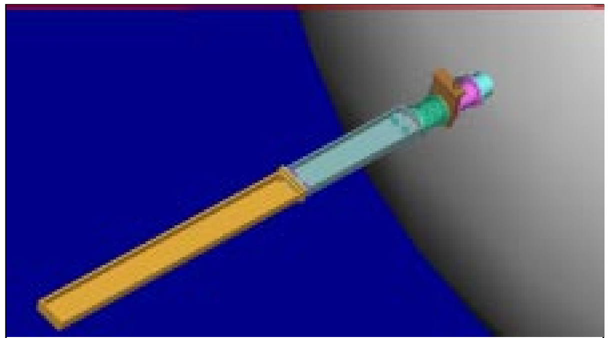
April 1994 Highlights of the Light Ion Inertial Confinement Fusion Program



Transmission grating diagnostic, designed by Sandia for NIF, that disperses the x-ray spectrum onto photoconductive detectors. The diagnostic is located outside the target chamber, a portion of which is also shown.

Preparations for the parasitic load experiments on PBFA II are complete. This series will identify the energy in non-lithium components as a function of time, space, spectra, and species type. Eight shots are to be fired with the diagnostics differing among the shots. Particle-in-cell and hydrodynamics simulations were used to select the diode configuration and to design the diagnostic set.

We are developing an ion source cleaning testbed to characterize DC and RF plasma cleaning techniques and inductive anode heating. System impurity removal rates are measured with a differentially pumped quadrupole mass spectrometer, in a geometry similar to that to be used on SABRE. With funding from us, Cornell and NRL researchers are designing experiments for the LION and Gamble II accelerators to diagnose and to reduce the energy in high-Z impurities. The SABRE studies will use the passive LiF ion source; the LION and Gamble II studies are using an exploding metallic film active anode plasma source.

Ion beam transport from the diode to the target is a key element of the light ion program. Time-resolved data of high spatial resolution are required to investigate beam uniformity and filamentation during ion beam transport. We have designed a framing-camera diagnostic for SABRE to address these issues. The diagnostic includes ion range filters to discriminate ion species and energy for passive and active sources.

Present light ion fusion target experiments use a barrel-shaped anode with a total transport length of 15 cm from the anode to the target. In the future we will generate and transport extracted beams over distances of several meters from the diode to the target. A divergence reduction strategy is being developed to reach a goal of 6 mrad microdivergence for 35-MeV lithium in a high-yield Laboratory Microfusion Facility. The strategy involves optimizing the divergence of 5 MeV protons in a single-stage diode on SABRE and the divergence of 14-MeV lithium in a two-stage diode on Hermes III. Our light ion transport reseach is concentrating on developing a physics understanding of gas breakdown, which is needed for an achromatic lens system and for self-pinched transport, as well as for other schemes that include ballistic transport. These transport issues are being addressed experimentally on Gamble II at NRL.

The 18-month collaborative (LLNL, LANL, SNL, and the University of Rochester) effort on the National Ignition Facility (NIF) is complete, and the Conceptual Design Review document has been submitted to the Secretary of Energy. The 192-beam glass laser is designed to deliver 1.8 MJ and 500 TW to hohlraum entrance holes. We were responsible for the power conditioning system, the target chamber, the target positioner, the first wall, and several of the target diagnostics.

Contact: Jeff Quintenz, Inertial Confinement Fusion Program, Dept. 1202, 505-845-7245, fax: 505-845-7464, email: jpquint@sandia.gov
Highlights are prepared by Mary Ann Sweeney, Dept.1241, 505-845-7307, fax: 505-845-7890, email: masween@sandia.gov.
Archived copies of the *Highlights* beginning July 1993 are available at http://www.sandia.gov/pulspowr/hedicf/highlights.